Conversion of APAAN *(α-phenylacetoacetonitrile)* into BMK *(benzylmethylketone)*

P-PG / Precursors (2013)3

by
The Netherlands Police Agency
National Dismantling Facility (LFO)

Pompidou Group
Groupe Pompidou

COUNCIL OF EUROPE
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Co-operation Group to Combat Drug Abuse and Illicit trafficking in Drugs

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Netherlands Police Agency National Dismantling Facility (LFO)

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Law enforcement

The main objective of the Pompidou Group's law enforcement activities is to reduce drug supply available on the markets by addressing drug trafficking as a criminal activity and as a form of organised crime affecting our security on an individual and social level, in line with the Pompidou Group's multi-disciplinary approach.

Law enforcement activities

These activities follow up on the work of the Criminal Justice platform (2007-2010) on:

- quasi-coerced treatment of drug-dependent offenders, including drug treatment courts, specialised magistrates as well as diversion programmes;
- recidivism
- drug addiction in prison
- drug precursors' diversion

In line with the Pompidou Group's multi-disciplinary approach, the activities promote the efficiency of law enforcement services in the fight against drug trafficking as well as those of other agencies involved in the control of legal trafficking of chemical precursors.

The added value of the Pompidou Group's law enforcement activities in comparison to those in other international fora is its geographical scope as an enlarged partial agreement allowing to network among interested parties in pan-European and Extra-European dimension.

The second main comparative advantage is the multidisciplinary composition of several of its expert committees and groups bringing together representatives from all competent drug-related services, be it law enforcement (police, customs, border guards), prosecution, the judiciary and/or regulatory authorities. This allows to improve effective international co-operation in the fight against drug trafficking and to accelerate procedures and concrete information exchange among responsible offers.

The themes dealt with by different expert groups include:

1. the development of a harmonised multi-disciplinary strategy for drug-detection at European airports and to enhance subject-related inter-airports co-operation;

2. the acceleration of information exchange among law enforcement, officers, representatives of regulatory boards and magistrates/prosecution in the field of combating illegal production and trafficking of chemical precursors and improvement of conditions for more rapid and direct contact among the agencies and services concerned;

3. the elaboration of guidelines aimed at reducing drug supply on a world-wide scale and the development of a drug supply reduction strategy with a view to strengthening international co-operation.

Prevention of drug precursors' diversion

Since 2009, three conferences were held on ''backtracking investigation, evidence collection, sanction, and prevention of drug precursors'' diversion and on ''the prevention of drug precursors'' diversion: perspectives for national and international co-ordination.'' The target audience of both conferences included magistrates, prosecutors, and judges, but also representatives from the chemical industry and law enforcement.

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Summary

Since the beginning of 2011, a large number of conversion labs have been found in the Netherlands. In these labs, α-phenylacetoacetonitrile (APAAN) is converted into benzylmethylketone (BMK). This large scale APAAN to BMK conversion takes place using a simple production method and limited resources and knowledge. There are different methods for APAAN to BMK conversion, involving different types of acid. Each conversion method has its own specific process-related problems and hazards. The acids used are phosphoric acid, sulphuric acid, and hydrochloric acid. Especially the use of hydrochloric acid may cause major environmental and health problems. This memorandum was drawn up to increase knowledge of the subject among emergency service providers and enforcement agencies, which will improve their chances of properly assessing the type of conversion method and the risks involved.

Introduction

α-phenylacetoacetonitrile, CAS Registry Number: 4468-48-8, is a white to light yellow crystalline powder produced from benzylcyanide. The substance is imported under different names, some of which are false. **Chapter 1** α-phenylacetoacetonitrile (APAAN) can be used as a raw material or reagent (building block) in organic synthesis, both in the chemical industry and in scientific research. There are very few known legal uses for APAAN. **Chapter 2**

There are different ways to convert APAAN to BMK:

1. APAAN with phosphoric acid (found in Poland)
2. APAAN with sulphuric acid, in which case:
    a. The required heat is generated by means of cooking vessels;
    b. The required heat is generated by the (exothermic) reaction between the sulphuric acid and water.
3. APAAN with hydrochloric acid.

Subsequently, the chemical and technical process of each conversion method is described. **Chapter 3** After the conversion, the BMK must be separated **Chapter 4** and can be purified. **Chapter 5**

In the Netherlands Forensic Institute (NFI)'s investigation of an illegal BMK production lab that used sulphuric acid and heating, the yield of pure BMK proved to be about 68% of the theoretical maximum yield. When the process was repeated on a smaller scale at the NFI's, the yield came to about 74%. The literature describes a yield of 77 to 86% for this BMK production process. **Chapter 6**

Though APAAN conversion labs can be investigated in the same way as 'regular' synthetic drugs labs, there are a number of specific focus areas, such as yield calculation in %, quantities produced, process setup, recipes found, etc. **Chapter 7**

APAAN to BMK conversion entails specific hazards and risks, resulting from the chemicals and production equipment used. Acids in combination with defective production equipment – plastic barrels and heating elements – present great risks. 'Modifications' made to the vessels cause major problems during stabilization, dismantling, transport and storage. **Chapter 8**

Many investigations have shown that waste created during the conversion and separation of the substances is dumped outdoors or drained in the sewage system. The conversion also produces significant emissions of harmful substances into the environment and/or the air. In many cases, the authorities and society had to cope with considerable damage to the environment and/or public facilities, such as the sewage system, after a conversion lab had been dismantled and removed. **Chapter 9**

In addition to the standard detection equipment used when a synthetic drug production location is entered, such as the GasAlert and the Micro-Alert that measure the concentrations of the most prevalent gases – CO, O_2, CH_4 (risk of explosion), and (optionally) NH_3 – specific other tools should be used in APAAN conversion labs to detect HCN (hydrogen cyanide) and HCL (hydrochloric acid). A thermal imager can also be used. **Chapter 10**

The choice of personal protection gear is addressed comprehensively in chapter 11. Based on the information in the chemistry charts and the operational experience gained, we know that working in conversion labs requires extensive personal protection, such as protective clothing and independent breathing equipment (oxygen). The use of independent breathing equipment and chemical or gas proof clothing is recommended due to the high concentrations of acids. We know from experience that the acids severely erode the independent breathing equipment, which is why this is best worn underneath the gas or chemicals suit. **Chapter 11**

After the technical and forensic evidence is gathered, the conversion laboratory must be dismantled. Dismantling an APAAN conversion lab is subject to a number of specific procedures, which should be observed in addition to the standard dismantling procedures. Attention must be given to cooling down the process, the 'modified' and/or damaged plastic barrels, separating the waste flows, the after-reaction process, the packaging, and the decontamination procedure. **Chapter 12** Thorough decontamination is required, due to the working method and the substances used. **Chapter 13** describes specific decontamination for the suspect(s), the arrest team, patrolling officers, and forensic staff, the fire brigade and dismantling facility staff.

After the lab has been dismantled and the equipment, chemicals and production waste have been packaged, the materials must be transported to a suitable storage location. During transport and storage, it is important to consider the release of fumes or gases as a result of an ongoing reaction in a mixture or the reactivity of certain substances. Storage must take place in well ventilated and chemical resistant facility. It is therefore essential that suitable transport and storage are used. **Chapter 14**

A press article published in Dutch daily "De Telegraaf" from the former Dutch National Public Prosecutor Mr. Cees van Spierenburg, regarding 'explosive labs' plus a brief description of the role and tasks of the Dutch Dismantling Team can be found in the **Annex.**

Driebergen, 12 December 2012
A.J. van Rijn

POLITIE

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Introduction

Since the beginning of 2011, a large number of laboratories for the conversion of α-phenylacetoacetonitrile to benzyl methyl ketone (BMK = 1 phenyl-2-propanone) have been found in the Netherlands and other European countries, including Belgium and Poland. Since the beginning of 2010, large quantities of this substance (tens of thousands of kilos) have been imported into the Netherlands, either directly from China, or via Belgium, Germany, Poland, Hungary, Slovakia, Bulgaria, Lithuania, Romania, Slovenia, Russia, Macedonia, and Italy.

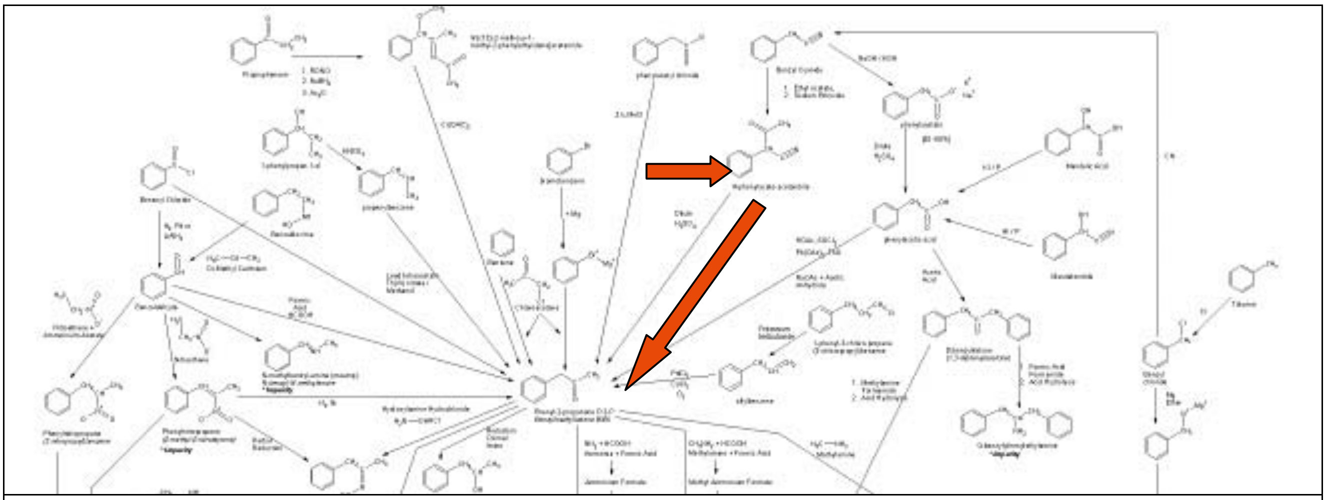
α-phenylacetoacetonitrile has not (yet) been included in the European regulations referred to in the Abuse of Chemical Substances (Prevention) Act. However, APAAN is included in the European Commission's Voluntary Monitoring List as a substance known to be used for drug production. The Custom Service's precursor brochure also mentions APAAN. The Public Prosecution Service considers APAAN a registered substance because it can easily be converted to BMK.

APAAN is frequently used for BMK production because:

- The price of APAAN is relatively low as compared to the price of BMK;
- APAAN to BMK conversion requires no specific chemical knowledge;
- APAAN to BMK conversion does not require complex or expensive production; and
- A high return (between 60% and 75%) is easily achieved.

BMK is listed as 1 phenyl-2-propanone in Category 1 of European regulations 111/205 and 273/2004.

As BMK is a chemical product that can be produced in various ways, APAAN is merely one of the pre-precursors that can be used for BMK production.



BMK (P-2-P) production diagram

APAAN to BMK conversion can be achieved in different ways, using different acids. Each conversion method has its own specific process-related problems and risks. Since February 2011, the National Dismantling Facility (LFO) has encountered a number of APAAN conversion labs that used sulphuric acid, while conversion using hydrochloric acid emerged in 2012. The latter method, in combination with the location of some of these laboratories – in residential areas – and the manner of processing and disposal of the hazardous production waste, resulted in a number of highly complex, risky, and time consuming dismantling operations conducted by the LFO. Many of these operations presented an acute danger to the people living in the neighbourhood, the emergency services, the investigating officers and the environment.

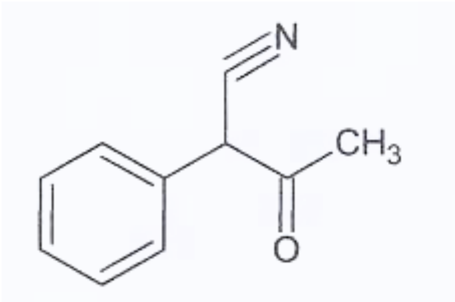
This memorandum was drawn up because the conversion methods differ substantially and may lead to serious danger. The objective is to expand knowledge of APAAN and the production of BMK to increase familiarity with the conversion process, thereby improving the ability to assess the type of conversion process and its inherent risks. This memorandum is based on the knowledge and experience gained by the LFO during Crime Crime Scene (CS) investigations and the ensuing technical investigations. In addition, we gladly used the analysis results gathered by the Netherlands Forensic Institute (NFI), and the NFI information bulletin on APAAN.

This memorandum addresses the following subjects:

1. General information about α-phenylacetoacetonitrile (APAAN)
2. Known applications
3. α-phenylacetoacetonitrile conversion processes – the following is described for each process:
    a. The chemical process
    b. The technical process
4. Separation
5. Purification
6. Yield of BMK produced from APAAN
7. Forensic focus points in CS investigation
8. Dangers and risks
9. Environmental aspects
10. Detection
11. Personal protection tools
12. Dismantling
13. Decontamination
14. Transport and storage
15. References
16. Annex

To improve readability and to clarify the text, we used photographs and technical and other drawings provided by the LFO. In addition, we used the information and chemical equations provided by the NFI's Narcotics Department.

1. General information about α-phenylacetoacetonitrile (APAAN)[1] [2]



Chemical formula for APAAN

Image of APAAN

<u>Synonyms:</u>

- 2-phenylacetoacetonitrile
- α-acetylbenzylcyanide
- 3-oxo-2-phenylbutanenitrile
- 2-oxo-1-phenylpropylcyanide
- 1-cyano-1-phenylpropane-2-on
- 1-cyano-BMK
- 3-keto-2-phenylbutyronitrile
- α-aceto-α-cyanotoluene

CAS number: 4468-48-8
EINECS: 224-737-4

Formula: $C_{10}H_9NO$
Molecular weight: 159.18
Melting point: 88 – 94 ^oC
Density: 1.086 g/cm^3
Physical form: white to yellow crystalline powder
Risk Codes: R20/21/22; R36/37/38
Transport Information: UN 3439

There have been several seizures of APAAN imported under false names or registration details. A few of these names or registration details are:

- 4-hydroxy-6,7-dimethoxyquinoline
- Benzoylbiphenyl (syn.: 4-phenylbenzophenone; CAS number: 2128-93-0)
- Butadiene-acrylonitrile rubber
- “Consol”

[1] Source: International Narcotic Control Board APAAN Alert No. 2/2012
[2] Source: Netherlands Forensic Institute, NFI Information bulletin on APAAN

- 4-Cyano-4'-n-dodecylbiphenyl (syn.: 4'-Dodecyl-4-biphenylcarbonitrile; CAS number 57125-49-2)
- Diphenylacetonitrile
- Hair conditioner, or hair lacquer (HS code: 3305.30.00)
- Lithopone
- Matt hardener (HS code: 3824.90.99.90)
- Pesticides
- PMC89809FF Pharmaceutical Product Phenylsalicylate
- Silicon dioxide
- Sodium hexamethaphosphate
- Sodium *d*-pantothenate
- Titanium dioxide
- Novadan Reinigungpulver
- 1-Hydroxy-6,7-dimethoxyquinoline
- Calcium stearate

Label on a bag of APAAN

2. Known applications [3]

The substance α-phenylacetoacetonitrile (APAAN) can be used as a raw material or reagent (building block) for organic syntheses, both in the chemical industry and in scientific research. The best-known application of APAAN is as a raw material for benzyl methyl ketone (BMK) synthesis, which is described in scientific literature and on various websites and internet forums with information about synthetic drug production. More recently a number of forensic publications have described the production of BMK from APAAN as discovered in various police investigations.

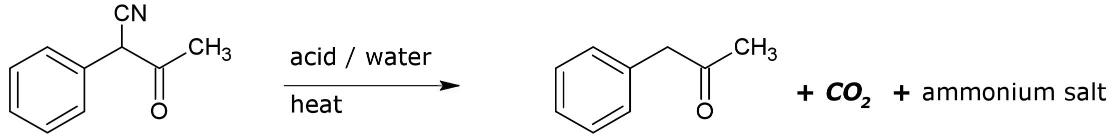
Two – obsolete – applications of APAAN are mentioned in the patent literature, in which APAAN is part of a synthesis route. The first application involves the synthesis of phenyl methyl fumaric dinitrile and phenyl methyl maleic dinitrile, substances that may be used in the production of colorants (GB739275-1955); the second involves the synthesis of a substance that is mentioned as a possible stabilizer of photographic emulsions (GB62994-1949): an amino-1,2,4-triazaindolizine. Given scientific progress, it is unlikely that the above processes are still in use.

[3] Source: Netherlands Forensic Institute – NFI Information bulletin on APAAN

3. α-phenylacetoacetonitrile conversion methods

Over the past two years, APAAN has been imported in bulk into Europe, and the Netherlands in particular. Shipments varying from 50 kg to 2,000 kg were taken into the Netherlands by road, water and air. The APAAN is usually packaged as a powder in cardboard barrels or boxes. In a number of cases, the packaging still contained the original labels, but in other cases, false labels stating a different substance name were used. This is called mislabelling.

The APAAN is subsequently taken to a location where it can be converted into BMK. This illegal conversion is relatively simple and does not require expensive production equipment or extensive chemical knowledge. The APAAN can be converted with the aid of a strong acid, such as phosphoric acid, sulphuric acid or hydrochloric acid, and in some cases heating of the reaction mixture. The conversion results in BMK, an ammonium salt, and CO_2. (plus some remaining acid and water).



APAAN | **P2P**

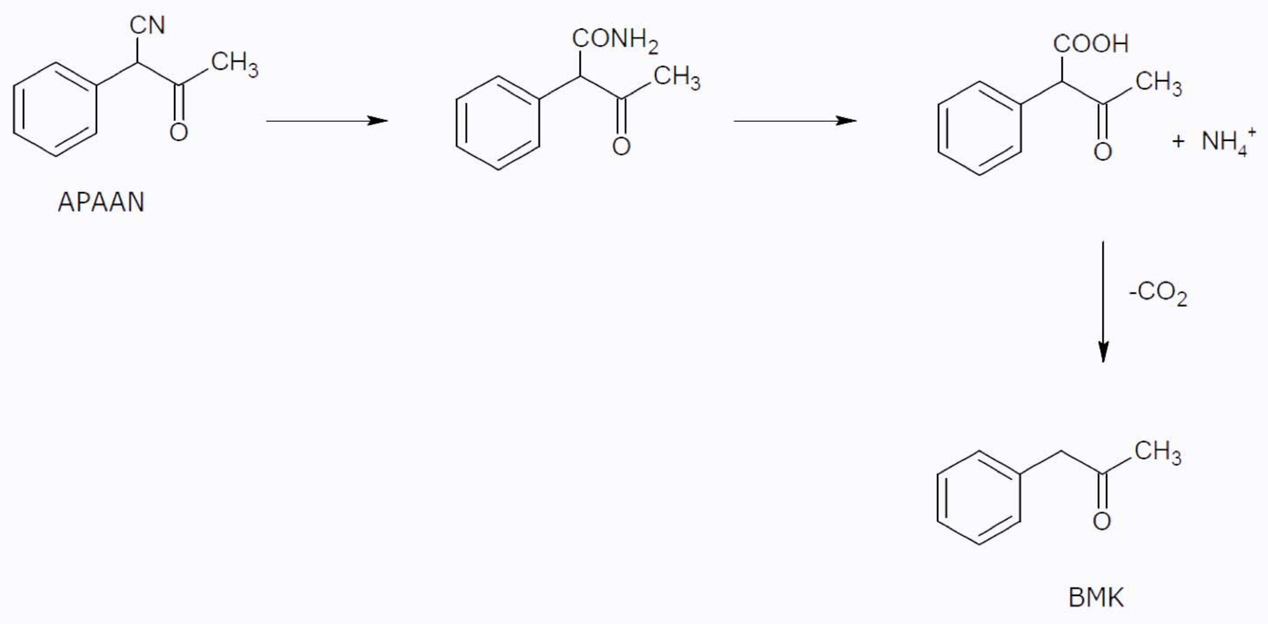
General conversion formula for APAAN

As the conversion process does not take place in an ideal production environment, or under the best of circumstances, the post-production residue will contain a mixture of BMK, acid, water, ammonium salt, and sometimes APAAN, depending on the substance ratios. In addition, the mixture will contain a number of by-products, generated by the BMK and the acidic conditions.

In a number of investigations it emerged that illegal producers use an excess of acids to ensure full conversion of the APAAN. If water is added to the process or if the acid contains water, the reaction mixture will contain water at the end of the conversion process. The water content will be small in case of phosphoric acid. Two layers of fluid will develop: BMK on top of an acidic watery fluid.

Ammonium salt crystal

The conversion of APAAN to BMK takes place in a number of stages, namely:



Intermediary stages of the APAAN to BMK conversion. Source: NFI – Narcotics department

APAAN to BMK conversion requires a hydrolysis reaction. This is a reaction with water that can be carried out using an acid (hydrochloric acid, sulphuric acid or phosphoric acid) or a strong base, such as caustic soda. (sodium hydroxide)

The reaction takes place in a number of stages. In hydrochloric acid, for example, the CN group is first converted into an acid group, COOH, simultaneously forming ammonium chloride. Chemically speaking, ammonium chloride is NH_4CL, which contains the N atom of the CN group. If sulphuric acid is used in the reaction, ammonium sulphate will be formed in this stage.

In the following reaction stage, decarboxylation takes place. This means that CO_2 is formed out of the acid group. After this, the reaction is finished and the APAAN to BMK conversion complete. Under normal conditions, no HCN – the extremely poisonous hydrocyanic acid – is formed during the reaction. It is unknown what happens if the same reaction takes place at very high temperatures.[4] In the known production processes, this can only happen if no water remains in the reaction system, as water ensures that the mixture's boiling point is 100°C. At 100°C, APAAN is in liquid form, which facilitates the blending process.

There are different ways to convert APAAN into BMK, namely:

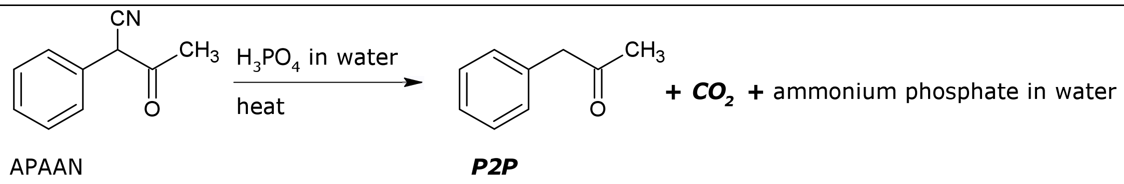
1. APAAN with phosphoric acid (found in Poland)
2. APAAN with sulphuric acid, in which case:
    a. The required heat is generated by means of cooking vessels;
    b. The required heat is generated by the (exothermic) reaction between the sulphuric acid and water.
3. APAAN with hydrochloric acid.

The chemical and technical processes will be described for each conversion method.

[4] Source: Netherlands Forensic Institute – Narcotics Department

3.1 APAAN conversion using phosphoric acid

The conversion of APAAN using phosphoric acid is a method that has not yet been encountered in production labs in the Netherlands, but was found several times in Poland.



Chemical equation for APAAN to BMK conversion with the aid of phosphoric acid

Description of the chemical process

In stage 1, APAAN is mixed with phosphoric acid. The mixture must then be heated to a temperature of 150°C up to 160°C to allow for proper conversion. This is a much higher temperature then when sulphuric acid or hydrochloric acid are used. No water is added to the reaction mixture; this would prevent the mixture from reaching the high temperature required, as water evaporates at temperatures > 100°C.

The mixture is heated for several hours, during which the oily crude BMK is separated from the acidic bottom layer. The bottom layer consists of acid with some dissolved BMK, ammonium phosphate and, potentially, some unconverted APAAN.

Description of the technical process

Given that the temperature of the reaction mixture must be 150°C up to 160^{o} C if phosphoric acid is used, an external heating source is required. There are several options, such as electric heating mantles and gas burners, which have the disadvantage that exact temperature control is impossible, or electric heating in combination with thermal oil.

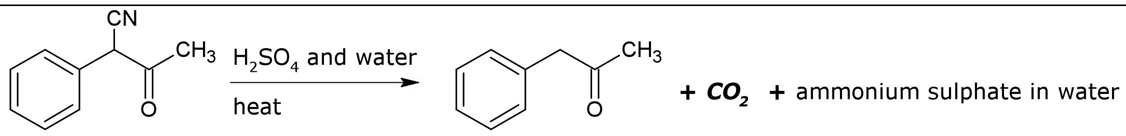
Thermal heating (Source: CBI Poland)

Glass vessels, such as round bottom flasks or reaction flasks, can be used as reaction vessels. Metal reaction vessels with a protective coating such as enamel or Teflon on the inside can also be used. The coating ensures that the strong acids do not corrode the metal.

Polish APAAN conversion lab (Source: CBI Poland)

3.2 APAAN conversion using sulphuric acid

The first APAAN conversion labs in the Netherlands used sulphuric acid and water.



APAAN **P2P**

Chemical equation of APAAN to BMK conversion with the aid of sulphuric acid

Two production methods were found for conversion with the aid of sulphuric acid:

a. Use of an external heating source;
b. Heating resulting from an exothermic reaction between the sulphuric acid and water.

Both methods will be explained in the following section.

3.2.1 Use of an external heating source

This conversion method requires a source of heat. In the first APAAN conversion labs that were discovered, 22-litre preserving kettles were frequently used. An advantage of these kettles is that they are easily modified. It is simple to make holes to install exhaust pipes for fumes and gases, and a stirring mechanism.

Description of the chemical process

Stage 1: the APAAN is mixed with water and concentrated sulphuric acid. The sulphuric acid may also be slightly diluted beforehand. As the mixing process generates a lot of heat, the mixture must be cooled. The reaction mixture can be cooled to 100° C, which makes it possible to immediately proceed to stage 2.

Stage 2: the mixture is kept at a temperature of 100° C for a little while, and subsequently cooled to below room temperature.

Heat image of a preserving kettle

Stage 3: a large quantity of water is added to the mixture, after it has been cooled to the right temperature.

Stage 4: the reaction mixture is reheated to 100° C and kept at this temperature for several hours, during which time the oily crude BMK separates from the acidic bottom layer. The bottom layer consists of diluted sulphuric acid, with some dissolved BMK, ammonium sulphate, possibly some unconverted APAAN and a few by-products.

When preserving kettles were used in one of the first APAAN conversion labs, the mixing ratio was 2.2 kg of APAAN to 4 litres of concentrated sulphuric acid and 12 litres of water.

Description of the technical process

During the first production stage, the APAAN is mixed with concentrated sulphuric acid. The heat generated in the process must be reduced by cooling the mixture. When preserving kettles were used, a cooling system consisting of a mortar tub with a drainage pipe in the base was installed. The preserving kettle was placed on three bricks on the bottom of the tub. The bricks prevented the preserving kettle from touching the wet base of the tub and the electric heating element from continued exposure to water.

A ring of plastic tubing equipped with thin nozzles on the inside had been installed on top of the mortar tub. This tubing had been attached to the water pipes, so that the nozzles sprayed cold water against the outside of the preserving kettle. This allowed for the controlled reduction of the reaction mixture's temperature. We will see a similar cooling system – a ring of tubing around the reaction vessel – in the description of other conversion methods.


Preserving kettles with cooling system


Installed cooling system

On top of the preserving kettles is a 24 Volt electromotor that powers a stirring mechanism, which mixes the APAAN with the acid, optimizing the reaction.

After completion of the second stage, the mixture is transferred to a second set of processing equipment. In this case, preserving kettles without a cooling system have been used. Water is added after the mixture has been transferred. The mixture is then heated to a temperature of 95 to 100° C. Because of their limited production capacity – about 1.5 to 2 litres of BMK per production batch – several preserving kettles are used simultaneously. These are all attached to an exhaust system that removes the poisonous or harmful fumes and gases.

In one of the first APAAN conversion labs (February 2011), six preserving kettles were used for the first and the second stage (mixing the APAAN with sulphuric acid) and 18 preserving kettles for stages three and four.

4 preserving kettles with joint exhaust installation

3.2.2 Heating by means of the exothermic reaction between sulphuric acid and water

This conversion method does not use an external heating source, but reaction heat generated by mixing sulphuric acid with water. The rate at which the water is added determines the amount of heat generated.

Description of the chemical process

Stage 1: the APAAN is mixed with water and concentrated sulphuric acid. As this generates a great deal of heat, the mixture must be cooled.

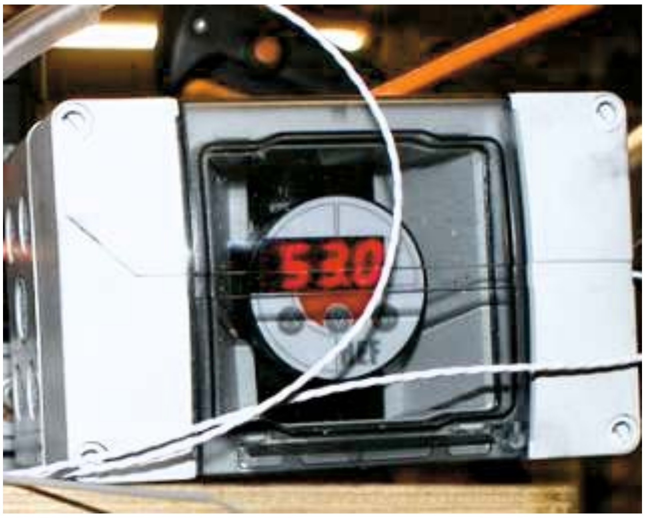
Stage 2: after cooling, a large quantity of water is added to the mixture. This should be done in a controlled manner. Mixing water and sulphuric acid generates a great deal of heat, which should be limited by adding the water little by little over several hours. The temperature should not rise too much. In the process, the oily crude BMK is separated from the acidic bottom layer. The bottom layer consists of diluted sulphuric acid, a little BMK, ammonium sulphate, and possibly some unconverted APAAN and a few by-products.

Description of the technical process

In principle, this conversion method is similar to the method that uses an external heat source. The first laboratory where this method was used was found in February 2011. In this lab, a plastic reaction vessel was used, with a content of 750 litres.

As was the case with the preserving kettles, this reaction vessel was equipped with a cooling system on the outside, consisting of a ring of copper piping with nozzles. The outside of the metal grid had been sealed with foil that caught the cooling-water. To heat the reaction mixture, water was added using a fluids pump. During the conversion process, the temperature was monitored by an electronic thermometer.

Plastic reaction vessel



Electronic thermometer

Subsequently, the content of the vessel was mixed using the stirring mechanism. The fumes and gases released in the process were cooled with the aid of a cooling system made from double-walled PVC tubes. This cooling system could be equipped with active carbon filters at the tail ends.

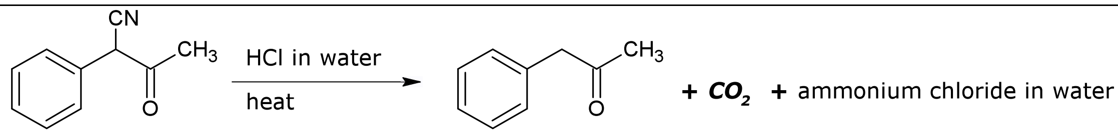
A large-scale conversion set-up like this was found only once. Usually, plastic barrels with band clamp lids are used, which are placed in a mortar tub. A similar cooling system is installed around the lids of these barrels. The mixture is stirred by a electrically powered stirring mechanism installed over the barrel. A disadvantage of this conversion set-up is that, unlike the preserving kettles and the plastic vessels mentioned above, this is an open process, which means that fumes and gases are released from the open top of the barrel and will spread freely throughout the production space. Therefore, the air in the production space should be extracted by an exhaust system, possibly in combination with an active carbon filter.

The emission from the reaction vessel into the production space is a major disadvantage of this set-up. Illegal producers, as well as investigation and emergency services, will be exposed to these fumes and gases in the case of a calamity and/or investigation. In addition, the material in the production space will be contaminated and corroded by the acid and poisonous fumes and gases. Further processing of the content of such large set-ups was shown to cause considerable pollution of the location.

Band clamp lid barrel with stirring motor and water-cooling system on the bottom

3.3 APAAN conversion using hydrochloric acid

Since June 2012, APAAN conversion labs have been found in the Netherlands in which concentrated hydrochloric acid is used instead of phosphoric or sulphuric acid. The main risk involved in this conversion method is the hydrochloric acid's strong evaporation. If heated, the hydrochloric acid gas will evaporate from the mixture. Without cooling the fumes and/or a good gas scrubber, the hydrochloric acid gas can be released into the environment and the air. As with phosphoric acid, the mixture will have to be heated during the production process. The use of a heating source (heating mantle) in combination with plastic clamp band lids in these laboratories is noteworthy.



APAAN **P2P**

Reaction equation for the conversion of APAAN to BMK with the aid of hydrochloric acid

<u>Stage 1 – the conversion reaction</u>

The APAAN is mixed with hydrochloric acid, at a ratio of 1 litre APAAN to 3 litres hydrochloric acid 36%. This mixture must be stirred thoroughly, and heated to a temperature of 95°C for a period of 10 hours, during which time the mixture must be stirred regularly. The fumes and gases generated during the process are removed through a gas scrubber, which neutralizes the fumes.

The heaters are turned off as soon as the conversion reaction is complete. The acidic, dark brown BMK will float on top of the fluid. It can be separated using a separatory funnel. If large quantities of APAAN have been converted into BMK, the BMK can be skimmed off using a metal ladle.

Description of the technical process

APAAN to BMK conversion using of hydrochloric acid does not require any complex or expensive production equipment. Since hydrochloric acid has a corrosive effect on iron and stainless steel, plastic barrels are used for the conversion reaction. These may vary in size from 80 to 220 litres.

The mixing of the reaction mixture of APAAN and hydrochloric acid is not done with electric mixing equipment, as is the case for APAAN conversion with sulphuric acid, but is usually done by hand, using a wooden or plastic stick or spatula.

In most conversion labs that used hydrochloric acid, the set-up resembled the schematic representation below.

Schematic representation of stage 1

The two outer barrel are used for the conversion of APAAN to BMK. Tubes protruding from the lids of these barrels lead into the central barrel, which contains a fluid – either a water and caustic soda solution or an alkaline soap – that neutralizes the fumes.

The central barrel may also contain an internal spraying mechanism: A submersible pump in the liquid and a ring of tubing with nozzles immediately under the lid create a mist of the liquid in the barrel. This is done to optimize neutralization and precipitation of the fumes.

Spraying mechnism

The fumes and smell released in filling, mixing and emptying the barrels is extracted by an extractor fan equipped on the front with an active carbon filter.

Conversion lab in Tilburg

Conversion lab in Heumen

As the reaction between the APAAN and the hydrochloric acid generates no or insufficient heat to complete the conversion to BMK, an external heating source is required. Heating mantles are frequently used for this purpose. In the industrial sector, these mantles are used to heat fluids with a melting point around room temperature for easier transport or processing.

Brochure with an overview of the various types of heating mantles

The heating mantle can be attached to the plastic barrel simply using three adjustable straps, after which the desired temperature is set with the aid of a thermostat.

Heating mantle thermostat

Applied heating mantle

4. Separation – stage 2

After the APAAN is converted to BMK, the BMK can be separated off using a separatory funnel or a metal ladle. At that time, the BMK is still acidic and can be neutralized using a caustic soda (NaOH) solution, with a ratio of 25 kg caustic soda to 50 litres water.

This reaction will generate heat. In some conversion labs, the barrels used for this stage are cooled in metal cooling basins filled with a layer of cooling-water. In the labs in question, the reaction mixture was pumped into plastic barrels in the cooling basins after the first stage: the conversion stage.

After the BMK is neutralized, it can be separated with the aid of a separatory funnel or a metal ladle.

Schematic representation of stage 2 – neutralisation -


Neutralization space


Barrel with floating dark coloured BMK

5. Purification – stage 3

After conversion and neutralization, the BMK is dark brown in colour, and can subsequently be purified or cleaned using steam distillation or another type of distillation. This distillation removes water and synthesis contaminations with boiling points that vary significantly from that of BMK. After distillation, the remaining BMK is pale yellow.

Comment:
The neutralization and purification stages are not essential. The acidic, dark brown coloured BMK can be used as it is for the production of amphetamine and methamphetamine. In some conversion labs, only the conversion process was found, other labs also showed evidence of the neutralization stage.

Schematic representation of steam distillation

6. APAAN to BMK conversion yield[5]

The NFI investigation of an illegal BMK production location, where APAAN was converted with the aid of sulphuric acid and heat, showed that approx. 2.25 kg of APAAN yielded approx. 1.27 kg of pure BMK. This is about 68% of the maximum theoretical yield. When the process was repeated on a smaller scale at the NFI on the basis of 64 grams of APAAN, a yield of about 74% was achieved, while the literature[6] describes a yield of 77 to 86% for BMK production with this process. It is unknown what the expected yield would be for the conversion of APAAN using sulphuric acid without an external heat source, or using hydrochloric acid.

The yield of APAAN to BMK conversion depends on several factors, including the purity of the raw materials, the conversion route, the reaction circumstances, and the purification degree of the final product. The reaction circumstances are determined by the producer's knowledge, the production equipment, and the conversion method. The yield may vary for each conversion location. It is therefore essential to carry out an extensive technical and forensic investigation of each production location.

The yield of each location can be determined on the basis of a technical and forensic investigation of this kind. This information is essential in the calculation of the illegally obtained profits and the ensuing confiscation proceedings.

[5] Source: Netherlands Forensic Institute - NFI Information bulletin on APAAN

[6] Bobranskii, B.R. and Drabik, Ya.V., New method of preparing 1-phenyl-2-aminopropanone, Chemical Abstracts 36, 1942, 2531.

7. Forensic focus points in a CS investigation

Though APAAN conversion labs can be investigated in a manner similar to the investigation of 'ordinary' synthetic drug labs, there are a number of specific points to be taken into account, namely:

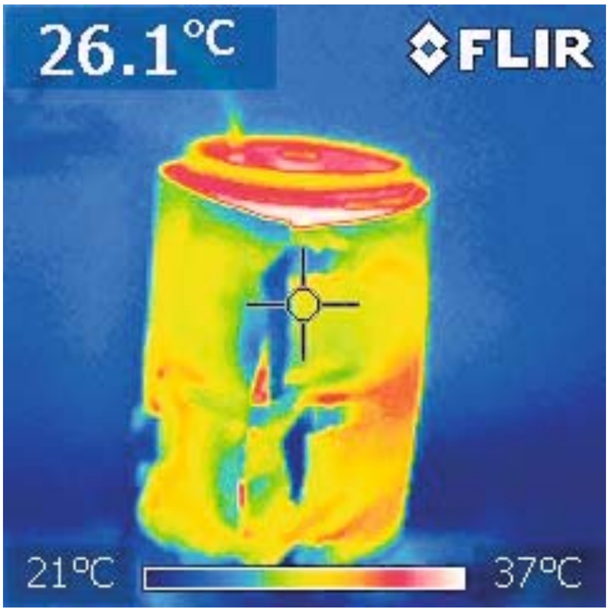
Yield calculation: To properly estimate the yield of APAAN to BMK conversion, it is necessary to accurately determine the quantity of BMK oil in the reaction vessel. For this purpose, the BMK must be separated either by using separatory funnel or by skimming.

Yield of APAAN conversion with the aid of sulphuric acid in a preserving kettle

The quantity produced: Based on the known reaction ratios or the recipes found it is possible to estimate the quantity of BMK produced. For APAAN conversion using hydrochloric acid, the ratio is 1:3, on the basis of 37% hydrochloric acid. It is important to identify and register all packaging, its original content and remaining content at all production locations. If possible, examine the chemicals to determine their concentration.

Process stages: As plastic barrels or reaction vessels are frequently used, the temperature of an ongoing production process must be determined at the time of entry. This is essential both for safety reasons and for the gathering of evidence. With the aid of a thermal image camera, such as the FLIR-i7, it is simple to measure the temperature at a distance and produce a digital photograph that can be used to assess the risks, determine the selection of samples, and serve as evidence.

If a heating mantle is used, it is impossible to determine the process temperature with the aid of a thermal imaging camera unless the mantle is removed, as it insulates the outside of the reaction vessel. In such cases, the temperature can be read on the heating mantle's control unit, and should subsequently be registered. It is also possible to use the thermal image camera to measure the heat at the top of the reaction vessel. This has the disadvantage that such an image does not reflect the stratification of the reaction vessel's content. In addition, it will be necessary to be close to the reaction vessel, which may be impossible because of the contamination risk, heat, tubing and cabling, or may be undesirable for safety reasons.



Thermal image with heating mantle

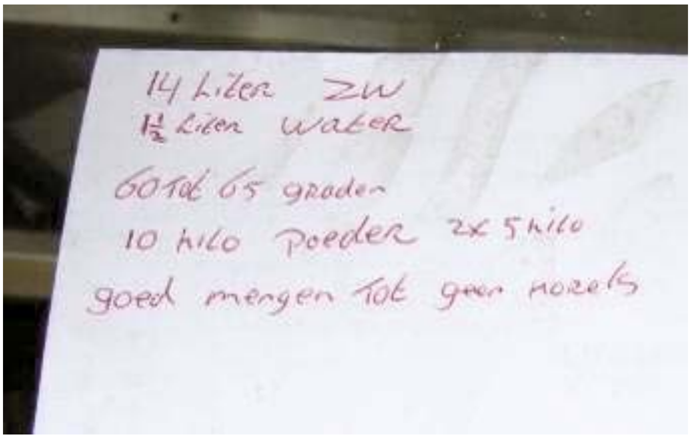
Thermal image without heating mantle

Recipes: Though the reaction itself is quite straightforward, there may be differences in the recipes used at the production locations that use the same APAAN conversion method. The difference may involve:

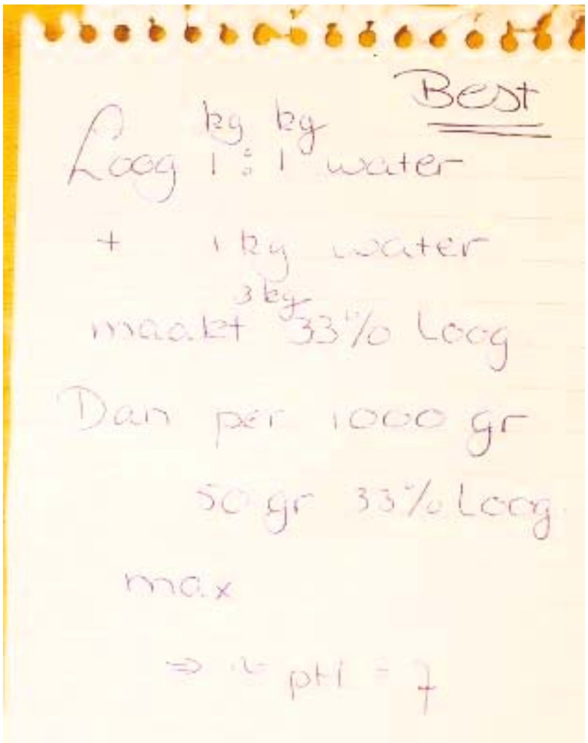
- Acid - APAAN ratio
- Concentration of the acid used in %, in combination with the quantity of water added
- Heating temperature
- Heating period
- With or without mixing
- With of without neutralization

The recipes found can be an indication of the above points. As recipes are frequently shared, similar recipes can be found at different production locations.

Recipes, in combination with a thorough inventory of the production location, and tactical investigation and analysis by the NFI's narcotics department, may provide information about the scope and yield of the production. This information can help the Public Prosecution Service to determine a penalty and a confiscation sum.



Recipe for APAAN conversion using sulphuric acid



Neutralization recipe for a reaction mixture containing BMK

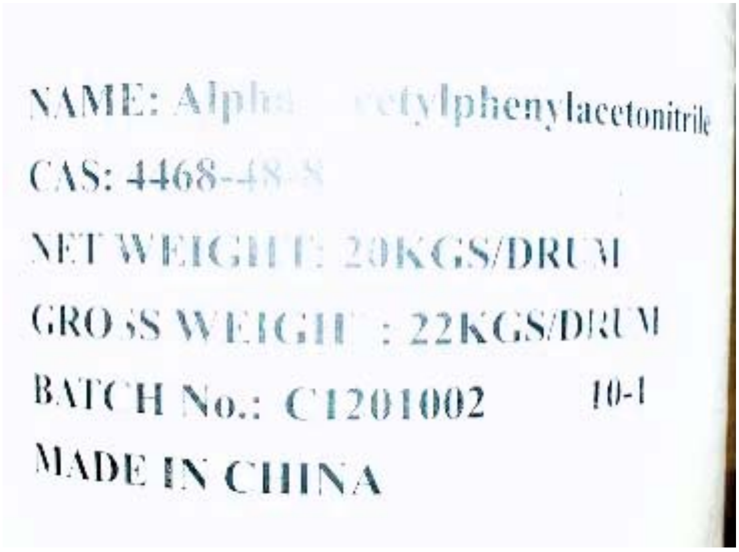
8. Dangers and risks

This chapter discusses the specific dangers and risks of the chemicals and production equipment involved in APAAN to BMK conversion. We will give a brief overview of the risks and dangers of the chemicals. We refer to the relevant chemistry charts for a full description. It should be noted that the actual situation may differ significantly from the information in the chemistry charts. Heating hydrochloric acid, for instance, will result in a major increase in vapour pressure, which will strongly increase its emission and concentration, and therefore the possible exposure to the chemical. The information in the chemistry charts can, of course, be used to choose detection equipment, personal protection gear, disinfectants, and emergency measures.

8.1 The chemicals used

α-Phenylacetoacetonitrile

CAS number: 4468-48-8



Physical characteristics	
Boiling point	-
Melting point	92 – 94 °C
Vapour pressure in mbar at 20 °C	Unknown
Density	1.086 g/cm
Solubility in water	Unknown
Important information	
White to yellowish crystalline powder	
MAC value	Unknown
MAC TGG-15min	Unknown
Smell	Typical chemical smell, some people vaguely smell bitter almonds.
Acute respiratory hazard	At 20°C this substance barely evaporates, but the powder can quickly reach a high concentration in the air if disturbed/atomized.
Manner of ingesting	The substance can be ingested by breathing in powder particles or by swallowing.
Direct consequences	This substance is irritating to the respiratory organs, eyes and skin, and can be damaging in higher concentrations.
Direct dangers	
Fire	The substance forms toxic fumes when heated to high temperatures, namely CN (cyanide) and NOx (nitrogen oxides).
Symptoms	
Inhalation	Irritating and harmful when inhaled
Skin	Irritating and harmful in case of skin contact
Eyes	Irritating to the eyes
Ingestion	Irritating and harmful when swallowed
Prevention	
Inhalation	Extraction system (general and localized), respirator (P2)
Skin	Gloves (butyl rubber, PVC), protective clothing

Eyes	Acid goggles, face shield with safety goggles, eye protection in combination with a respirator.
Ingestion	-
First aid	
Inhalation	Fresh air, rest, semi-sitting position, and immediately call in emergency medical aid.
Skin	Remove contaminated clothing, rinse for at least 20 minutes in lots of water, and consult a physician
Eyes	Rinse with water for at least 15 minutes. Remove contact lenses, if worn, then take the victim to a physician or an ophthalmologist. Continue rinsing the eyes during transport.
Swallowing	Rinse the mouth and spit out the water! Do not induce vomiting, and immediately call in emergency medical aid.
Emergency situation	
Fire causes an acute health hazard! Immediately clear and cordon off the danger zone. Alert an expert.	
Environmental consequences	
Unknown	

α-phenylacetoacetonitrile is produced from benzyl cyanide. The α-phenylacetoacetonitrile molecule contains a cyanide group that, during the conversion to BMK, is not removed or converted as a whole, but in parts. The release of a cyanide compound may lead to serious health damage, or may even be fatal. Because the conversion takes place in a strong acid – phosphoric, sulphuric, or hydrochloric acid – in the presence of water, little or no cyanide will be released during the conversion process.[7] (see chapter 3: types of APAAN conversion)

It should be noted that cyanide may be released when the production process is overheated, for instance if gas burners are used, or if there is a fire. A fire at a production location where α-phenylacetoacetonitrile is stored in powder or partly processed form is therefore extremely dangerous, especially if the location is not recognized as an APAAN lab or storage facility.

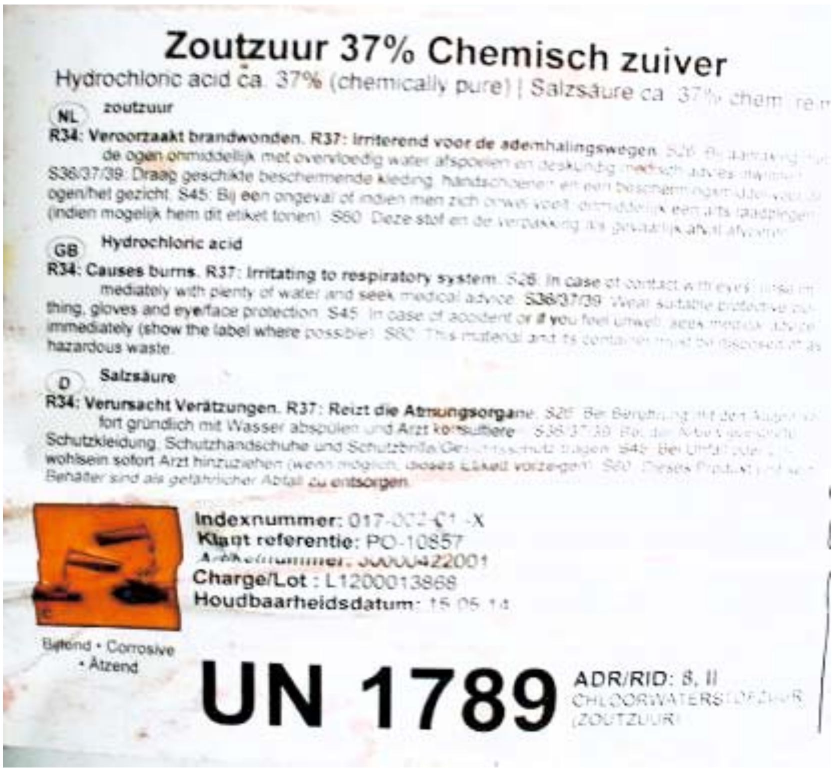
Cyanide is mainly known as the hydrogen cyanide gas compound (HCN), the potassium salt of hydrogen cyanide [= potassium cyanide (KCN)], and the calcium salt [= calcium cyanide], because of their immediate toxic effect.

The cyanide ion combines with cytochrome A3, a cell enzyme in the respiratory chain, which blocks the dissimilation (exchange) of oxygen. This causes death within minutes. The lethal dose of KCN for an adult is estimated at 10mg/kg, and for HCN at 3.7 mg/kg (these are the LD50 values for rats). Some people are able to smell hydrogen cyanide: they notice a vague almond-like smell. Whether or not you smell this is genetically determined and most people will not notice anything.

[7] This is unlikely as far as we know. Further research into the release of cyanide is in progress. As long as we have no absolute certainty in this matter, possible release of cyanide should be considered.

Hydrochloric acid (about 37% in water)

CAS number 7647-01-0



Physical characteristics	
Boiling point	57 °C (forms an azeotropic mixture, boiling point 108 ° C, contains 20.22% HCL)
Melting point	-35 °C
Vapour pressure in mbar at 20 °C	158 mbar
Relative density in relation to water	1.2
Relative density (air =1)	1.04
Soluability in water	Fully soluble
Important information	
Forms corrosive acidic mists in air, that are heavier than air and spread along the ground. The solution in water is a strong acid, reacts violently with bases, and is corrosive. It corrodes many types of metal, while forming combustible gas (hydrogen). Reacts violently with oxidizers, forming toxic fumes (including chlorine). Can react with formaldehyde, forming the highly poisonous dichloromethylether.	
MAC value	5 p.p.m. – 8 mg/m^3
MAC TGG-15min	10 p.p.m. – 15 mg/m^3
Smell	It is unknown whether smelling the substance in harmful.
Acute respiratory hazard	Evaporation of this substance at 20°C can rapidly result in a harmful concentration in the air.
Manner of ingestion	The substance can be ingested by inhalation of the fumes or by swallowing.
Direct consequences	The substance burns the eyes, the skin, and the respiratory organs. Inhalation of the fumes or mist may cause pulmonary oedema, but only after symptoms of burning of the mucosa of the eyes and/or higher airways. Exposure to high concentrations of the substance may cause death. The effects may be delayed.

Direct dangers	
Fire	Non-combustible
Symptoms	
Inhalation	Burning, sore throat, coughing, shortness of breath, laboured breathing, wheezing.
Skin	Burning, redness, pain, blisters, burns.
Eyes	Burning, redness, pain, visual impairment, excess lacrimation (flood of tears).
Ingestion	Burning, blisters on the lips and in the mouth, burning pain in the mouth, throat, gullet, and stomach; nausea, vomiting, diarrhoea, shortness of breath.
Prevention	
Inhalation	Extraction system (general and localized), respirator (combination filter type BE/P2)
Skin	Gloves (butyl rubber, PVC), protective clothing
Eyes	Acid goggles, face shield with safety goggles, eye protection in combination with a respirator.
Ingestion	-
First aid	
Always consult a physician!	
Inhalation	Fresh air, rest, semi-sitting position, immediately call in emergency medical aid.
Skin	Remove contaminated clothing and rinse for at least 20 minutes with lots of water, or take a shower. Consult a physician.
Eyes	Rinse with water for at least 15 minutes. Remove contact lenses, if worn, then take the victim to a physician or an ophthalmologist. Continue rinsing the eyes during transport.
Swallowing	Rinse the mouth and spit out the water! Do not induce vomiting, and immediately call in emergency medical aid.
Emergency situation	
Acute health hazard! In case of significant quantities: immediately clear and cordon off the danger zone or ask a competent party to do so. Alert an expert.	
Environmental consequence	
This substance is harmful to the aquatic environment.	

Sulphuric acid (37 – 98% in water)

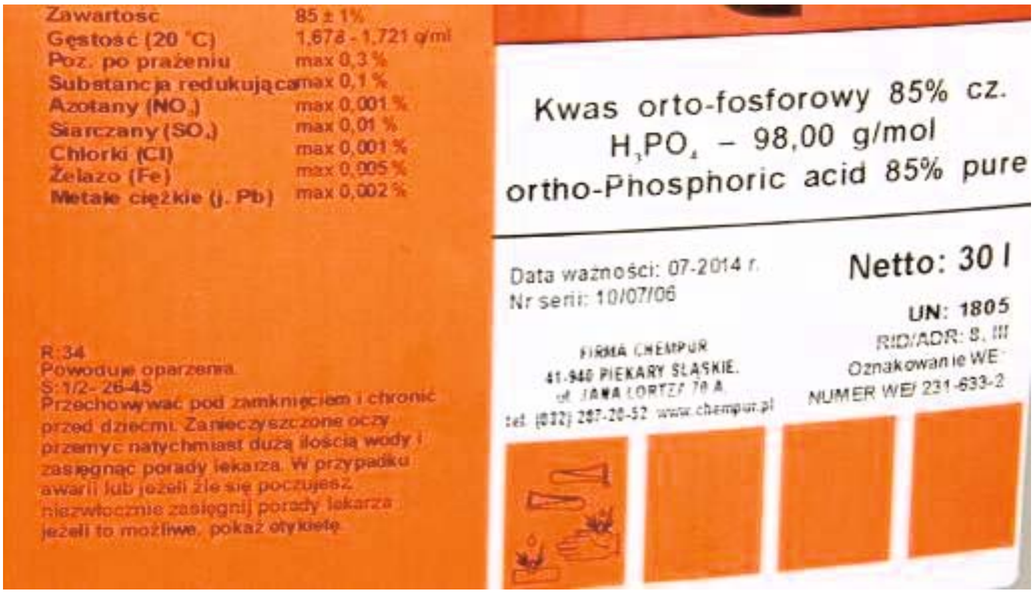
CAS number: 7664-93-9

Physical characteristic	
Boiling point	> 100 °C (boiling point of the 64% solution is 142°C, boiling point of the 98% solution is 290 °C)
Melting point	-32 °C (64% solution)
Vapour pressure in mbar at 20 °C	0.001 mbar
Relative density in relation to water	1.84
Relative density (air =1)	3.4
Solubility in water	Fully soluble
Important information	
Colourless solution. The fumes mix well with air. When heated or burned, the substance separates, forming poisonous fumes, including sulphur dioxide. The substance is a strong oxidizer, and reacts violently with combustible and deoxidizing substances, and corrodes clothing. It is a strong acid and reacts violently with bases and is corrosive. It corrodes many types of metal, while forming a combustible gas (hydrogen). The concentrated acid does not affect led and steel. Reacts violently with oxidizers like chlorates, permanganates, and organic substances, solvents, and many other substances, causing a combustion and explosion risk.	
MAC value	1 mg/m^3
Acute respiratory hazard	Evaporation at 20°C cannot or only very slowly cause a harmful concentration of the substance in the air. Atomization will cause a harmful concentration much more quickly.
Manner of ingestion	The substance can be ingested by the body by inhalation of the fumes, by inhalation of the aerosol, or by swallowing.
Direct consequences	The substance and the fumes burn the eyes, skin, and respiratory organs. It burns if swallowed. Inhalation of the fumes or the aerosol may cause pulmonary oedema. After swallowing, the substance may reach the lungs, which would cause pneumonia. Exposure to high concentrations of the substance may cause death.
Direct dangers	
Fire	Non-combustible. Risk of combustion or explosion due to the many reactions.
Explosion	Risk of explosion due to the many reactions.

Symptoms	
Inhalation	Burning, coughing, difficulty breathing, shortness of breath, blue lips or nails, palpitations, laboured breathing.
Skin	Burning, burns that do not heal well.
Eyes	Burning, redness and pain, corneal damage, impaired visibility, serious burns.
Ingestion	Burning, blisters on the lips and in the mouth, stomach cramps, nausea, diarrhoea, coughing, shortness of breath, laboured breathing.
Prevention	
Fire	No open fire, no sparks, and no smoking. No contact with metals and organic substances.
Inhalation	Ventilation, Extraction system (general and localized), respirator (filter type E).
Skin	Gloves (butyl rubber, polyethylene), protective clothing.
Eyes	Acid goggles, face shield with safety goggles, eye protection in combination with a respirator.
First aid	
Fire	In case of fire in direct surroundings: all extinguishing substances allowed.
Inhalation	Fresh air, rest semi-sitting position, apply artificial respiration if necessary, specific treatment required. Immediately call in emergency medical aid.
Skin	In case of skin burns, do not remove any stuck clothing. Rinse with a lot of water first, then remove clothing, then rinse again. Consult a doctor and immediately call in emergency medical aid.
Eyes	Rinse with water for at least 15 minutes. Remove contact lenses, if worn, then take the victim to a physician or an ophthalmologist. Continue rinsing the eyes during transport.
Swallowing	Rinse the mouth and spit out the water! Do not induce vomiting, and immediately call in emergency medical aid.
Emergency situation	
Acute health hazard. Immediately clear and cordon off the danger zone or ask a competent party to do so. Alert an expert.	
Environmental consequences	
This substance is harmful to the aquatic environment.	

Phosphoric acid (25 – 85% in water) – (ortho-phosphoric acid)

CAS number: 7664-38-2



Physical characteristics	
Boiling point	158 °C (for an 85% solution)
Melting point	< 21 °C
Vapour pressure in mbar at 20 °C	2 mbar
Relative density (air =1)	1.0
Solvability in water	Fully solvable
Important information	
Colourless and practically odourless solution. The fumes mix well with air. The substance separates when heated or burned, forming toxic fumes, including phosphorus pentoxide (see below). The substance is a moderately strong acid and reacts violently with bases, and is corrosive. It corrodes many types of metal, forming combustible gas (hydrogen). Reacts violently with oxidizers and many other compounds.	
MAC value	0.2 p.p.m. 1 mg/m^3
MAC TGG-15min	0.5 p.p.m. 2 mg/m^3
Acute respiratory hazard	A concentration in the air that causes a health hazard will be reached fairly slowly as a result of evaporation at 20 °C; much more rapidly when the substance is vaporized
Manner of ingestion	The substance can be ingested into the body by inhalation of the fumes, through the skin, and by swallowing.
Direct consequences	High concentrations of the substance burn the eyes and respiratory organs. An aerosol of the substance burns the skin. Inhalation of the fumes may cause pulmonary oedema, but only after a burning effect on the mucosa of the eyes and/or higher airways. Exposure to higher concentrations may cause death.
Direct dangers	
Fire	Non-combustible.
Symptoms	
Inhalation	Burning, irritation, sore throat and coughing, difficulty breathing, shortness of breath, laboured breathing.
Skin	Redness and pain, a burning sensation and blisters.

Eyes	Burning, redness and pain, impaired visibility, corneal damage, serious burns.
Ingestion	Burning, blisters on the lips and in the mouth, stomach cramps, nausea, vomiting, diarrhoea.
Prevention	
Inhalation	Ventilation, extraction system (general and localized), respirator (combination filter type BE/P2).
Skin	Gloves (butyl rubber, PVC), protective clothing.
Eyes	Face shield with safety goggles, eye protection in combination with respiratory protection.
First aid	
Fire	In case of fire in the direct surroundings: all fire extinguishing substances allowed.
Inhalation	Fresh air, rest, semi-sitting position, apply artificial respiration if necessary. Consult a physician and immediately call in emergency medical aid.
Skin	In case of skin burns, do not remove any stuck clothing. Rinse with a lot of water first, then remove the clothing, then rinse again. Consult a doctor and immediately call in emergency medical aid.
Eyes	Rinse with water for at least 15 minutes. Remove contact lenses, if worn, then take the victim to a physician or an ophthalmologist. Continue rinsing the eyes during transport.
Swallowing	Rinse the mouth and spit out the water! Do not induce vomiting, and immediately call in emergency medical aid.
Emergency situation	
Acute health hazard. In case of large quantities immediately clear and cordon off the danger zone or ask a competent party to do so. Alert an expert.	
Environmental consequenc	
This substance is harmful to the aquatic environment.	

Sodium hydroxide (caustic soda)

CAS number: 1310-73-2

Fysical characteristics	
Boiling point	1390 °C
Melting point	318 °C
Vapour pressure in mbar at 700 °C	1 mbar
Solvability in water	111
Important information	
White hygroscopic solid substance in various forms. The substance is a strong base, reacts violently with acids and is corrosive to various metals, including aluminium, copper, magnesium and zinc. Reacts violently with halogenated hydrocarbons and nitro compounds, with a risk of combustion and explosion. Reacts with water (soluble), generating significant heat, and the risk of forming burning mist.	
MAC value	Not established
Acute respiratory hazard	At 20°C this substance barely evaporates, but the powder can quickly reach a high concentration in the air if disturbed.
Manner of ingestion	The substance can be ingested by breathing in powder particles or by swallowing.
Direct consequences	The fumes of the substance burn the eyes, the skin, and the respiratory organs. Swallowing the substance causes burning. Inhalation of the substance may cause pulmonary oedema. The effects may be delayed.
Direct dangers	
Fire	Non-combustible.

Symptoms	
Inhalation	Burning, sore throat, coughing, shortness of breath, laboured breath, unconsciousness.
Skin	Burning, redness, pain, burns.
Eyes	Burning, impaired visibility, serious burns.
Swallowing	Burning, sore throat, diarrhoea, stomach cramps, vomiting.
Prevention	
Inhalation	Ventilation (if not in powder form), localized extraction system, respirator (filter type P2)
Skin	Gloves (butyl rubber, PVC)
Eyes	Face shield with safety goggles, eye protection in combination with respiratory protection.
First aid	
Fire	In case of fire in the direct surroundings: all fire extinguishing substances allowed.
Inhalation	Fresh air, rest, semi-sitting position, apply artificial respiration if necessary. Immediately call in emergency medical aid.
Skin	Remove contaminated clothing and rinse for at least 20 minutes with lots of water, or take a shower. Immediately call in emergency medical aid.
Eyes	Rinse with water for at least 15 minutes. Remove contact lenses, if worn, then take the victim to a physician or an ophthalmologist. Continue rinsing the eyes during transport.
Swallowing	Rinse the mouth and spit out the water! Do not induce vomiting, and immediately call in emergency medical aid..
Emergency situation	
Acute health hazard. In case of large quantities, immediately clear and cordon off the danger zone or ask a competent party to do so. Alert an expert.	
Environmental consequences	
This substance is harmful to the aquatic environment.	

8.2 Production equipment

Band clamp lid barrels in combination with heating mantles

No expensive and complex equipment is required for APAAN to BMK conversion. Mostly barrels with band clamp lids are used, modified to form reaction vessels, separation vessels or gas scrubbers with the aid of tubing and tube couplings.

The content of these barrels is normally between 150 and 200 litres. They will be filled about 60 to 80% full with a mixture of APAAN and hydrochloric acid, or the post-reaction mixture that needs to be separated.

The barrels are heated using 230V electric heating mantles. In various conversion labs we discovered that the thermostats of these heating mantles were set at 110 °C to 120 °C. The heating mantles contain a large number of horizontal spiral-shaped wires. These wires are covered by synthetic fibres, the mantle. When an electric current is sent through these wires, heat will develop as a result of the wires' resistance. This heat is then transferred to the covered barrel.

The heat transfer is greatest where the spiralled wires are situated. As the plastic band clamp lid barrels are not intended to be heated to temperatures of 110 °C to 120 °C, the plastic will melt or be burned in at wire level, which will decrease the integrity of the barrel. In a number of conversion labs that used the plastic barrels, the barrels showed various degrees of damage on the outside. In some cases, an attempt was made to prevent the barrels from melting by wrapping their outside with aluminium tape.

The damage to the barrels has major consequences for dismantling and the transport. If the barrels are still filled with a mixture of hydrochloric acid and APAAN, and have a total weight of 100 to 150 kg, extreme care must be taken when dismantling the lab. Transfer of these barrels, whether or not with the aid of mechanical tools such as a barrel trolley or a fork lift, may lead to leakage or even total rupture of the barrel. Release of a large quantity of hot or cold APAAN with hydrochloric acid will result in an enormous uncontrollable emission, with far-reaching consequences for the dismantling team, neighbours, the surroundings and the environment. Also refer to the chapter 'Risks and dangers'.

Burned in barrel

Applied aluminium tape

<u>‘Modified’ band clamp lid barrels</u>
Suitable production equipment must be used, depending on the chosen production method. As indicated earlier, barrels with band clamp lids are frequently used. They are usually modified to make them suitable for the production method in question.

In many case, holes will be made in the lid and/or the side of the barrel, through which plastic tubing or piping is inserted. These tubes or pipes are often connected to a gas scrubber, which ensures that (most of) the fumes developed during the process are absorbed or neutralized. However, these holes are not always gasproof, and will cause problems when dismantling, transporting or storing the content of the lab. In all cases, these barrels will have to be packaged in larger-sized barrels or bags.

Modified barrels with a connection on top

Barrel with side connections

In one case, an Intermediate Bulk Container (IBC) was found, containing about 700 liters of APAAN conversion waste. This IBC could not be transported to a location where the content could be removed because of a hole in its side. The content had to be poured or pumped into another vessel on site, which caused a major hydrochloric acid emission in the closed off production space.

IBC containing acidic APAAN conversion waste

Hole in the side

9. Environmental aspects

As described in the previous chapters, the conversion of APAAN requires acids – phosphoric acid, sulphuric acid, or hydrochloric acid – and potentially a caustic substance, such as caustic soda.

The conversion and possibly the separation stage result in a quantity of BMK and a quantity of waste. The waste can be divided into the following two categories:
- solid waste
- liquid waste

The solid waste may consist of a combination of:
- APAAN residue;
- ammonium salts, such as ammonium phosphate, ammonium sulphate or ammonium chloride

The liquid waste may consist of a combination of :

- spent acid, either phosphoric, sulphuric or hydrochloric acid
- spent caustic substance, such as caustic soda
- water
- BMK residue
- Liquid used in the gas scrubber, such as caustic soda or a soap solution
- Synthetic contamination, depending on the purity of the raw material and the manner of conversion

In addition to the solid and liquid waste, there will be an emission of fumes and gases into the air. This emission will consist of CO_2, which is generated during the conversion process, and acidic fumes. In the case of an uncontrolled chemical reaction or a fire, it is possible that other fumes and/or gases will be formed, including CN or HCN: cyanide or hydrogen cyanide.

It has already been established in many conversion labs that 'alternative' manners of waste disposal were used, in addition to the 'traditional' method: dumping it in barrels in the environment.

9.1 Dumping waste into the soil

A large part of the waste generated by the conversion process, and potentially the separation process, is liquid. If we look at the estimated quantity of APAAN that enters the Netherlands, and the mixing ratios with acid and, in some cases, with water, it is clear that tens of thousands of litres of liquid waste must be generated. If this quantity is compared with the discovered waste dumped in barrels, investigated by the National Dismantling Facility (LFO) and the Dutch Fiscal Intelligence and Investigation Service (FIOD), it is clear that a large part of the liquid waste is not dumped in barrels, but is drained off illegally into the soil or the sewerage system.

In a number of cases it was established that both liquid and solid waste were dumped in the ground. In one conversion lab, solid and liquid waste were dumped in a hole that had been hacked in the concrete floor. This hole, some 2.5 metres deep, had been dug right down to groundwater level. The conversion lab was located in a residential area, and the waste spread through the groundwater stream.


Hole hacked in the floor


Waste dumped at the bottom of the hole and into the groundwater

It should be clear that this manner of 'waste disposal' has far-reaching consequences. In such cases, the forensic investigation must be complemented by an environmental investigation (sample taking) and involvement of the competent authorities (municipality, province, etc.).

9.2 Discharge into the sewerage system

As most of the waste is liquid, it is relatively easy to get rid of it by pouring it into the sewer. The discharge of the acidic waste products, in combination with the BMK, APAAN and other residue, can have far-reaching consequences for the sewerage system. Especially when discharged in large quantities, the acids can corrode the concrete sewage pipes. Depending on the distance to the biological sewerage treatment system and the degree to which they mix with other sewage, the acidic waste products can also seriously damage the aerobe sewerage treatment, as the bacteria used in this type of treatment process are susceptible to major acidity fluctuations.


Discharge into a municipal sewer

In one conversion lab, a large hydrochloric acid emission took place as a result of a calamity. The fire brigade put up a water curtain to cause the fumes to precipitate. As a result, the local sewer system was overloaded. As large quantities of waste had been discharged into the sewer, the flood of water spread the substances by means of the sewerage system, which led to a great number of stench complaints in the area around the conversion lab.

9.3 Emissions into the air

During the conversion process, fumes and gases will be released, especially if a heating device and/or 'smoking' 37% hydrochloric acid are used. Tubing and a gas scrubber in combination with a general exhaust system (an exhaust with an active carbon filter) will be used to keep the concentration of harmful and acidic fumes and gases as low as possible. Part of the acidic or otherwise harmful fumes and gases will then be neutralized or absorbed. Another part, however, will be emitted into the surroundings of the conversion lab.

This will lead to stench complaints, especially in residential areas. In addition, the vegetation in the area can be affected by the acidic fumes, particularly in case of a calamity. A major emission may take place if leakage from a corrupted barrel occurs or if the conversion process gets out of hand.

Affected growth

10. Detection

In addition to the standard detection tools used when entering a synthetic or other drug production location, such as the GasAlert and the Micro-Alert, which monitor the concentrations of the most prevalent gases such as CO, O_2, CH_4 (explosion risk), and optionally measure the NH_3 concentration, APAAN conversion labs require specific other detection tools.

The use of plastic or other reaction vessels without a temperature indicator makes it impossible to get an idea of the process temperature. This is why an electronic thermometer or a thermal imaging camera is required. The presence of fumes and gases should also be considered. Gas detection tubes, such as Dräger tubes, or detectors such as a hydrochloric acid detector, can be used to detect acids. The use of simple pH paper is another way of measuring the acidity of the fumes or gas at an emission point.

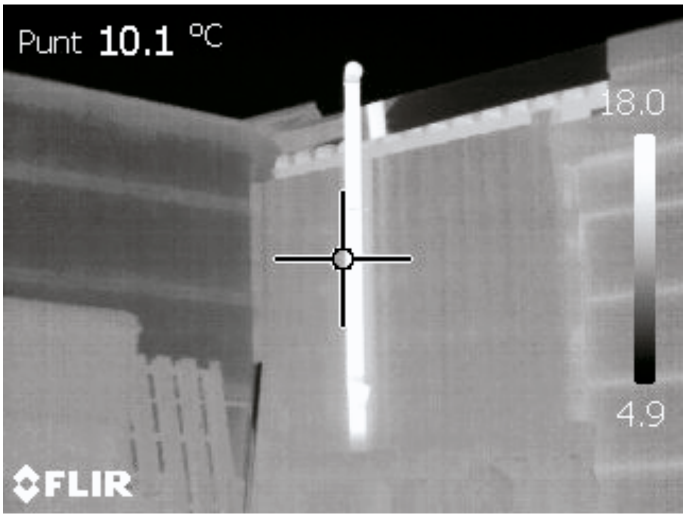
As it is always possible that HCN – hydrocyanic acid gas – may have been emitted as a result of a fire, for instance, a specific HCN detector should also be used.

A high concentration of hydrochloric acid gas

Thermal imaging camera

The temperature of an ongoing conversion process should be measured the moment the lab is entered. As plastic barrels without temperature indicators are used, it is essential, both for safety reasons and for the gathering of evidence, that the temperature of an ongoing process is measured (see chapter 7 – Process set-up). It is easy to measure and digitally photograph the temperature from a distance with the aid of an infrared thermometer and a thermal imaging camera, such as the FLIR-7. The photograph can be used as both risk assessment tool and evidence.

In addition, the temperature can be monitored during the gathering of technical evidence, which helps determine the moment that the actual dismantling activities can start. A thermal imaging camera can also help determine the layering and content level in the plastic barrels, or metal and/or coated reaction vessels. A thermal imaging camera can also be used to detect temperature differences on the outside of the production location, for instance in or around outlets or wall ventilators, etc.



Exhaust outlet at a production location

Thermal image of a 200 litre barrel

Gas detection

As indicated in the introduction, special gas detectors should be used, such as the HCN detector and optionally the hydrochloric acid detector. Electronic measuring equipment that monitors continuously is preferable to gas detection tubes that only measure the gas concentration at the moment of use. This is especially necessary because the entire investigation will cover a considerable period of time – 8 to 20 hours –, takes place in different spaces, and involves various activities:

reconnaissance, stabilization, forensic investigation and dismantling. In addition, there may be differences in the possibility of natural or forced ventilation.

It is also necessary to bear in mind that the local or regional fire brigade will carry out measurements in case of a calamity. This may involve the emission of a large quantity of hydrochloric acid in a residential area that is mistaken for smoke and reported to the emergency services as a fire. The fire brigade and the local or regional police will usually be the first to arrive at the scene and will carry out the standard gas detection procedure. As many fire brigades are insufficiently informed about the conversion processes and the gases and fumes that may be released during these processes, the standard gas detection equipment will detect little or no danger, and the all-clear will erroneously be given.

In the past, the all-clear was sometimes given because the gas detector was not equipped to detect the gases released during the production or conversion process. Especially as synthetic drug production and precursors are changing rapidly, developments have to be monitored continuously. New production processes using new chemicals will entail new dangers. These new dangers require new detection equipment, adjusted personal protection material, decontamination equipment, and strategies, not only at the actual production or conversion locations, but also for the examination of the substances, for instance when taking samples of chemicals and production waste.

HCN measurement with the GasAlert

11. Personal protection equipment

In addition to the use of gas detection equipment, ample attention must be paid to the choice of personal protection equipment. The information in the chemistry charts immediately makes clear that working in conversion labs require extensive personal protection, such as:

- Protective clothing
- Respiratory protection.

Especially labs where it is not immediately clear which chemicals and/or processes have been used require a high level of personal protection. After all, the production market has changed significantly over the past two years, resulting in, among other things, different types of APAAN conversion labs.

Dead flies in APAAN lab

<u>Protective clothing</u>

The chemistry chart indicates that protective clothing made of PVC or butyl rubber should be worn when working with the acids described above. In APAAN conversion labs, these substances are found as raw materials in jerry cans or barrels, in the reaction mixture, or as part of the waste. The combination of substances and their respective and joint chemical and physical characteristics are often unclear.

If the substances are heated to temperatures of approx. 95 – 100 °C, there will be a particularly high degree of evaporation, and exposure may lead to serious injury. Exposure could be extensive if a calamity takes place, for instance during the dismantling process. The scale of the incident depends on the production temperatures used, the size of the production batch (100 to 150 litres), and the chemical and physical characteristics of the production mixture.


Unprotected skin

Because of the high concentration of acids and other substances, the use of fully closed protective gear, such as a chemical suit or a gas suit, is required. The use of chemical overalls, preferably in combination with taped off gloves and boots is therefore strongly recommended. The high process temperatures, the potentially high outside temperatures, the labour intensiveness of the investigation, and the hermetical nature of the suit (no ventilation), however, will rapidly cause perspiration. As the acids used in the process will react with moisture, the damp body parts will be affected first if an overall or suit is not fully hermetically sealed. The acid will enter the suit through the openings and will first damage the neck, groin, backs of the knees, armpits, and genital area. Refer to the photograph in chapter 10: a space with a high concentration of acid requires 100% secure and hermetically sealed protective gear.

Dismantling in a Splash 2000 chemical suit

Respiratory protection

When working with chemicals, APAAN conversion process mixtures, and the waste generated in the process, respiratory protection should be used. The chemistry chart book recommends using a gas mask with canister, at the very least.

In practice, however, the necessity of a gas mask may vary from case to case. When taking samples of known substances, such as pure product for instance, in a well-ventilated room, using the required safety equipment, an experienced sample taker may be able to work without respiratory protection if the exposure period and the concentration of the substances are limited. It should be noted, however, that if there is any doubt about the nature of the substance or the experience or training of the sample taker, no risks should be taken and respiratory protection should be used. This applies not only in the case of liquids, but also of powders.

In all cases, the APAAN was imported in solid form – white to light yellow powder or chunks – packaged in boxes or barrels, usually double-wrapped in plastic bags. As soon as these bags are opened, a vapour is released to which the Micro-Alert gas detector responds. Values of > 15 p.p.m. were measured. It is as yet unclear whether this is possible because HCN is present, or whether a cross-sensitivity of the gas detector is involved. This is being investigated. Despite the possible cross-sensitivity of the detector, respiratory protection must be used in the form of a gas mask with canister, type ABEK-P2.

In the large APAAN conversion labs, oxygen cylinders were used. Initially, the cylinders were worn outside the chemical overalls. It soon became clear, however, that high concentrations, especially of hydrochloric acid, (in case of calamities or dismantling) corroded the oxygen equipment, which decreased proper functioning. The masks and cylinders were rejected when re-inspected after use. Examination by the supplier showed that the equipment had been irreparably damaged at essential points (low pressure – mid pressure – high pressure) so that proper functioning could no longer be guaranteed.

Corroded mask Corroded external buffer connection

If the use of respiratory protection, such as oxygen masks and cylinders, possibly with an external buffer connection, is required in an APAAN conversion lab, one should be aware that this equipment can be corroded by the high acid concentrations. The only way to prevent this is to wear a chemical suit or a gas suit, with the cylinders and the mask worn on the inside. This will prevent damage and simplify decontamination after the event. And decontamination is essential!


Reconnaissance in chemical suits – Splash 2000

12. Dismantling

After the forensic and technical evidence has been gathered, the conversion lab must be dismantled. When dismantling APAAN conversion labs, a number of specific points deserve special attention, in addition to the standard dismantling procedures.

Cooling the process mixture – removing the heating mantle
After the conversion lab has been entered and the process has been stopped, the temperature of the process mixture will fall. If a heating mantle is used, which is wrapped around the plastic barrel, and the temperature of the reaction mixture is at its maximum (95 °C to 100 °C), it will take a long time for the reaction mixture to cool to a temperature suitable for removal or for pumping into another vessel (< 30 °C). This is because the heating mantle insulates the content of the barrel, which means the fall in temperature will be extremely slow.

As soon as the conversion process in the lab is stopped, and the photo and video registration is complete, the heating mantles must be removed, and wrapped as contaminated waste after they have been registered (photograph and documentation of brand, type, serial number, etc.). It is recommended to subsequently use a thermal imaging camera to photograph the uncovered barrel to determine the temperature, content and stratification of the mixture.

Production barrels – damage and/or instability
When heating mantles are used (temperatures of up to 110 °C), the integrity of the barrels will be affected. If the barrels sustain too much damage, they may leak or rupture. The application of holes in the side for the insertion of tubes or piping may have a similar effect. Rupture of the instable barrel due to physical force should therefore always be considered, especially when moving the barrels. Another thing to be considered is the fact that not all barrels can be pumped out completely. In case of solidified APAAN and/or ammonium salt, the barrel will contain a hard, solid mass that cannot be pumped out. And even if the liquid is pumped out, some acidic liquid residue will remain. Such barrels should be treated with the utmost care and should only be removed inside larger-sized barrels.

Transfer of the content of an IBC

Released hydrochloric acid fumes

Separating waste flows –measuring acidity

In case of APAAN conversion in plastic barrels using hydrochloric acid, an additional plastic barrel is used as a gas scrubber. Tubes connect this barrel with the reaction vessels, and lead the acidic fumes released into the gas scrubber, where they are neutralized or absorbed. Water, a caustic soda (NaOH) solution, or soap can be used as neutralization liquid.

Conversion set-up with two reaction vessels and a gas scrubber in the middle.

When the liquid in the reaction vessels is emptied, a pump is used to pump the liquid into an IBC. As the conversion requires an acid, the pH value of the mixture will be low. If this liquid is pumped into the IBC, followed by the content of the gas scrubber, a violent chemical reaction may take place: an acid-caustic or an acid-water reaction. Therefore it is essential to always measure the pH value of the content of a vessel before the liquid is pumped out, and to pump the content of the gas scrubber into a separate vessel or IBC. When pumping out the liquids, the corrosiveness of the acids should be taken into account. It is recommended for rinse the pump to be rinsed with a soapy solution each time a barrel has been emptied. The soapy solution used for this purpose should be stored separately, away from the chemicals and waste products.

<u>After-reaction of the reaction mixture: determining the degree of conversion</u>
A problem with APAAN to BMK conversion is that it is difficult to determine the progress of the process. While an illegal producer knows exactly what has been added when, and whether the conversion process is completed, the investigating officer can only guess the progress of the conversion process. Though a thermal image can be obtained using a thermal camera, it gives no indication of the progress of the process. The degree of stratification of the reaction mixture is a better progress indicator.

The problem with APAAN is that it solidifies at temperatures below 88 °C – 92 °C. If the unconverted APAAN solidifies while in the acid, the acid will be incorporated into the solid mass. Another substance that can incorporate the acid when it solidifies is ammonium salt. This means that the reaction or evaporation of the acid will continue after the liquid acid has been pumped out. As a result, gas and fumes can accumulate in a closed barrel, which may result in overpressure.

Solidified APAAN - ammonium salt with acid and BMK residue.

Packaging

All contaminated materials should be packaged before transport. Particularly the components used in the conversion process are often very severely contaminated with acidic residue. If the plastic barrels used for APAAN conversion have been emptied, they still contain chemical residue. The problem is that holes have been made in the lids of these barrels to fit tubing or piping. Especially when dismantling the larger laboratories, it is infeasible to bring along new lids for all these barrels, as different sized barrels are used.

As an emergency solution, the top of a plastic band clamp lid barrel can be covered with a plastic bag. The lid and the band clamp are then placed on top, sealing the barrel and preventing leakage. Subsequently, the barrel can be placed in a larger-size bag, which is then closed.

Airtight sealing of a damaged barrel

<u>Contamination</u>

In most conversion labs, chemicals and waste products are not handled with care. Floors, walls, and sometimes ceilings may be severely contaminated with these substances. After all goods, chemicals and waste products related to the conversion lab have been removed, a severely polluted location will be left behind. In all cases, the local authorities need to be informed of this pollution. Depending on the rights of ownership, the location – residential or rural area – and the degree of pollution, the competent authorities can take action immediately to limit or clean up the pollution.


APAAN contamination on the floor


APAAN, BMK and acid contamination

It is essential to inform the competent authorities about APAAN, the chemicals used, and the potential waste products. It has become clear that environmental and research bureaus have no knowledge of APAAN and the other substances in question. If possible, it is recommended during the forensic investigation that samples of environmental pollution (water, soil, sewage) be taken in addition to samples for the benefit of evidence under the Opium Act and/or the Abuse of Chemical Substances (Prevention) Act. Such samples should be taken in duplicate: one for further environmental criminal investigation, and one for the environmental department of the competent authorities, after permission has been granted by a public prosecutor or examining judge.

The location must be closed off and sealed before it is abandoned to prevent visitors from being exposed or contaminated. This can be done by either the local police or the competent authorities. After completion of the criminal investigation, the actual responsibility for the location must be transferred to the local authorities.

13. Decontamination

As indicated in chapter 12, most conversion labs are severely contaminated with APAAN, the acids used, and the waste products generated. This contamination usually affects the floor. This means that **every single person** who has been inside the lab must be decontaminated.

Suspects

Arrested suspects will have their clothes and shoes removed outside the laboratory. Their clothes and shoes must be sealed in airtight bags for two reasons:

- Clothing and shoes serve as evidence: they contain traces of the person who wore them and of the products, chemicals and waste present in the conversion lab;
- Contamination of police vehicles and buildings should be prevented. APAAN, and especially BMK, has a pungent odour, especially at higher temperatures. In addition, contamination of police vehicles and buildings may lead to high decontamination or replacement costs.

Upon arrival at the location where they will be remanded in custody, the suspects must shower immediately under supervision. Because of the inevitable exposure in the conversion lab, the suspect must undergo a medical check up and be monitored.

Arrest team – arrest unit – patrol officers

The persons who have been inside the lab to arrest suspects or for investigation purposes (for instance during a cannabis clear out) must also be contaminated. Their contamination will usually be limited to their shoes, and sometimes part of their clothing. Shoe soles with deep grooves will carry the sticky APAAN residue, and any acids or waste present, and will spread these further.

Forensic staff – fire brigade – LFO staff

The persons entering the conversion lab as part of their duties – such as reconnaissance, stabilization, technical evidence gathering, and dismantling – will certainly be contaminated, as they have physical contact with chemicals and equipment. The contamination risk is especially high in the case of a calamity. Despite the use of personal protection, there will always be a risk of exposure. This is why a decontamination unit must be installed before the conversion lab is entered.

In the event of an emergency, such as a fire or calamity, it may be impossible to wait for a decontamination unit to be installed. In these cases, emergency decontamination must be applied, using large quantities of water. At a decontamination unit, the chemicals and waste products are best removed using water and soap (Extran MA-01).

It is recommended for a security advisor to be appointed at such production locations.

Decontamination unit

All materials used, such as protective clothing, respiratory protection, gas detectors, sample taking materials, and other equipment like pumps, must be considered contaminated, and must be packaged or decontaminated as such.

14. Transport and storage

After dismantling and packaging, all equipment, chemicals and waste products must be transported to a storage location. If the transport takes place in a lorry without cargo space ventilation, it should be considered that fumes or gases may be still be released as a result of an ongoing chemical reaction. This means exposure may take place when the lorry is opened.

At the storage location, the equipment, chemicals and waste products removed must be stored in a suitable place, with due care for the possible ongoing chemical reaction of the substance mixtures. In case of one dismantled APAAN lab, the reaction of the mixture was still ongoing after three days, with gas and fumes rising from the storage barrels. Particularly if concentrated 37% hydrochloric acid has been used, the fumes will react with moisture in the air, which will produce a white mist. Such an emission at a hazardous waste deposit location is risky and may cause a calamity. Therefore, it is recommended that the deposit manager be informed of the content of the barrels and the possibility of an ongoing reaction. Because of the process specific and chemical characteristics of the substances and waste products, this information should be provided by the team that dismantled the laboratory in question.

Ongoing reaction at a hazardous waste deposit location

15. References

- Netherlands Forensic Institute – narcotics department; NFI information bulletin on APAAN
- Chemistry charts book
- LFO photograph database
- Police Rotterdam Rijnmond

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16. Annex

Article published in Dutch daily "De Telegraaf"

Explosive labs

A second fireworks disaster like the one that happened in Enschede, the Netherlands, a few years ago, is one of the most gloomy scenarios Cees van Spierenburg can imagine. As National Public Prosecutor for the combat of synthetic drugs, he sounds the alarm about criminals taking exorbitant risks by setting up drugs labs in city centres. This phenomenon is observed with increasing frequency.

Mr. C. van Spierenburg

"Most of them just mess about as complete amateurs. Those people do not even consider what might happen if things go wrong. If running a drugs lab in a residential area decreases the risk of getting caught, that is where they'll go."

Unfortunately, the Enschede doom scenario very nearly became reality in Tilburg at the end of August. The police arrested three Tilburg citizens who accidentally revealed themselves as a result of a mistake in the BMK production process. BMK is the raw material for amphetamine. The white smoke that escaped from a number of sheds due to a 'little mistake' turned out to be a true hydrochloric acid cloud. It was a miracle that no one got hurt. "Things might have gone horribly wrong. Hydrochloric acid is terrible stuff."

According to the 64-year-old Van Spierenburg, the increasing safety risks go hand in hand with the criminals taking a new approach. Instead of the drugs themselves, they now manufacture the raw materials for drugs, using APAAN, a substance that was until recently unknown in the Netherlands. This powdered substance is easily available, but dangerous to work with. "Strong acids are needed for the conversion of APAAN to BMK."

Despite the risks, the criminals in question do not hesitate a second to apply the new strategy as much as they can. There was a shortage of the raw material BMK in the Netherlands, as the main supplier of the substance, China, prohibited production of and trade in this liquid. "In our country, the substance had already been banned for a while, so criminals are now trying to bend the rules and remedy the shortage by producing the substance themselves." According to Van Spierenburg, this is a gap in the drugs market, given the potential financial profits.

“A kilo of APAAN costs 30 euros and will yield 700 euros worth of BMK. It is a new method that is hard to beat.”

Seizure

A ban on APAAN would be a huge step forward in the combat of synthetic drugs. If Van Spierenburg has his way, this will definitely happen. The Public Prosecution Service already acts in accordance with this wish. “Preparing the production of drugs is forbidden by law. As it is so easy to produce BMK from APAAN, I am of the opinion that possession of APAAN should be punishable. That is why we are seizing the stuff.” A major seizure was made earlier this year when a batch of 1000 kg of APAAN was seized at Amsterdam Airport Schiphol.

But Van Spierenburg is also aware of the fact that as long as clear legislation is not in place, he will continue to cross swords with criminals that try to find the loopholes in the law. “Our approach to BMK turned out to be successful, which is why criminals try to steal a march on us by finding these loopholes. They now do this by importing APAAN, a new substance.” Despite everything, the combat of synthetic drugs continues unabated. “At international drugs conferences we indicate that APAAN is causing major problems in the Netherlands. Hopefully, other countries will understand and ban the substance. But this will take time.”

The National Dismantling Facility

The National Dismantling Facility (*Landelijke Faciliteit Ondersteuning Ontmantelen*: LFO) springs into action whenever a synthetic drugs laboratory is detected, 24 hours a day, seven days a week. And this is of course where they got the name. But they are also deployed more widely: if chemical waste has been dumped, or after an explosion on a tanker, a plane crash, or an accident involving a tank truck… Whenever chemical substances form a threat, the LFO is called to the scene.

The LFO was set up in 2001, in response to political pressure, as part of the programme “Conspiring against XTC”. The LFO swiftly gained acceptance as an obvious *multidisciplinary* partner in the fight against drug-related serious organized crime as well as within the security process within the Netherlands’ twenty-five security regions.

Initially, the LFO focused mainly on the safety aspects of investigations involving the dismantling of MDMA (XTC) and amphetamine-type laboratories. Partly as a result of changes in the market, their domain has since expanded. In addition to investigating the ‘traditional’ products, nowadays they conduct investigations into the illegal manufacturing of precursors (APAAN and safrole conversion), synthetic cannabinoids, designer drugs, medicinal products (e.g. Viagra), methamphetamine, synthetic explosives etc, and also dismantle cocaine extraction and heroin cutting laboratories. The number of investigations has also increased rapidly. In 2011, the LFO was called in to over 360 incidents. In 2012, this number has risen to over 500, particularly due to the explosive growth of APAAN conversion labs and related import, storage, and dumping.


Large mobile amphetamine laboratory


Large dump site

In addition to the expansion of the LFO's work domain, we have seen drug labs becoming more and more professional, both in terms of capacity and yield. Laboratories of industrial dimensions are often found, making use of industrial or purpose-built professional equipment that uses electronics and applications from the pharmaceutical and chemical industry. This leads to high-risk, complex and lengthy investigations calling for both chemical and process-technological or mechanical engineering expertise.


Industrial scale manufacturing of MDMA

The LFO's task is to provide forensic support for activities at crime scenes that involve very high safety or chemical or CBRNE-related risks. The LFO dismantles drugs production units and related storage and dumping locations and conducts forensic and safety investigations at crime scenes that may have CBRNE contamination.

The LFO's in-depth specialism –*the ability to conduct a CBRNE*[8] *investigation within 2 hours under all high-risk circumstances* – is frequently used within investigations throughout the Netherlands. Partly because it has been trained and is equipped to act at the highest safety levels, including hazmat suit, compressed air, and high-quality detection and identification instruments, the LFO shares in the responsibility for the forensic investigations in the 'hot zone' of CBRNe incidents. The LFO also provides safety advisors for high-risk investigations, and has four fire-brigade consultants on hazardous substances available for secondment, or on call at all times.

Apart from ascertaining the truth about the circumstances of a possible criminal offence, investigations also focus on the intelligence aspects of these or other international, national, or regional investigations. If LFO experts structurally carry out or contribute to such investigations, they can log, process, and share visual similarities and information. In this way, intelligence is collected that can help direct the course of the investigation, and insight is provided into current trends and developments.

In some cases, the LFO's expertise is perceptibly present during dismantling operations for the National Crime Squad, regional police forces, or other investigative services. In other cases, the LFO expertise may be deployed covertly in the event of secret collaboration with various surveillance teams and arrest squads. The senior LFO experts' extensive knowledge and experience, and the availability of unique, specialized, high-quality detection and identification devices are exceptional both within the Netherlands and further afield, and these features have been proven to possess significant added value for many investigations which are aimed at combating drugs, precursors, essential chemicals, and means of production.

[8] CBRNE: chemical, biological, radiological, nuclear, explosives

On the spot identification of chemicals

Identification new production equipment + technical drawing for report for court

Due to the swiftly evolving market and the increasing risks, the LFO – in addition to its investigative activities – has a role to play in education and training. For this purpose, the LFO uses a real-time training centre in Zaandam, the Netherlands, unparalleled anywhere in the world. In this laboratory, all the existing production processes have been set up using production equipment that has been seized and made available by the Public Prosecution Service. Depending on the target group and the learning objectives, very realistic training courses can be given, involving booby-traps, fire, smoke, gas, and physical violence. The existing production set-ups are updated frequently. The LFO also has various mobile laboratories that can be set up in simulated crime scenes at geographically diverse locations. Frequent participants in the courses include fire-brigade specialists, arrest squads and counterterrorism units, detectives, forensic experts, members of the Public Prosecution Service and the judiciary, and also international participants. The LFO members also frequently act as guest speakers or key-note instructors at many international conferences and training courses.

Combined training LFO – Counter terrorism unit

Dismantling

Innovation is another crucial task for the LFO. In the context of the expansion of tasks, the growing complexity of investigations, and the increasing influence of technology in investigations, the LFO organises and facilitates various innovation projects. These include developing a field test for the extraction of cocaine from synthetic sources and the use of SPME fibres (Solid Phase Micro Extraction) for the detection of precursors, for example. The development of knowledge documents or teaching modules, such as the present APAAN document, is also one of the LFO's tasks.

The LFO will continue to specialize and develop in an innovative way within the Central Unit of the new Dutch National Police, which will come into being on 1 January 2013. And of course it will continue to cooperate closely with its national and international partners. This development will take place in the context of the swift-growing and ever more complex national and international market of synthetic drugs and other drugs, CBRNe and chemical incidents.

For any further information, please contact: lfo@klpd.politie.nl

Pompidou Group
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